ON THE ROBUST SOLUTION TO A CLASS OF PERTURBED SECOND-ORDER SYLVESTER EQUATION [1]

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Abstract. This paper considers the solutions to a class of perturbed second-order Sylvester equation. Based on the parametric solutions to the normal second-order Sylvester equation, this problem of solving the perturbed second-order Sylvester equation is changed into a minimization problem with no constraints, and then a simple and effective algorithm for this problem is proposed. An illustrative example and its simulation results show the effectiveness of the proposed approach.

Keywords. Sylvester matrix equations, R-controllable, parameterization, perturbation.

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1 Introduction

In vibration and structure analysis, the second-order linear system captures the dynamic behavior of many natural phenomena, and has found wide applications, whose state equation can be given as follows

$$E\ddot{q} - A\dot{q} - Cq = Bu \tag{1}$$

where $q \in R^n$ is the generalized co-ordinate vector; $u \in R^r$ is the input vector; and E, A, B, C are matrices of appropriate dimensions. The matrices in (1) satisfy the following assumptions:

Assumption A: The matrix triple (E, A, B) is R-controllable, that is,

$$\mathtt{rank}[A - sE \quad B] = n, \forall s \in \mathbf{C}$$

Assumption B: The matrix B is of full rank, that is, $\mathtt{rank}(B) = r$.